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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/827,041	04/19/2004	Sung-bo Hwang	29925/39914	2383

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EXAMINER
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BOOTH, RICHARD A

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

10/827,041

**Applicant(s)**

HWANG, SUNG-BO

**Examiner**

Richard A. Booth

**Art Unit**

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>0904</u> . | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Zafar et al., U.S. Patent 6,413,819.

Zafar et al. shows the invention as claimed including a method for manufacturing a semiconductor device comprising: forming a tunnel oxide film 30 on a silicon substrate 12 where a predetermined substructure is formed; forming a particulate layer 16 containing silicon particles 18 of thirty angstroms on the tunnel oxide film layer; sequentially forming a control gate oxide film layer 28 and a control gate layer 24 on the particulate layer; and forming a dual gate structure by patterning the control gate layer, the control oxide film layer, the particulate layer and the tunnel oxide film layer into a predetermined shape (see figs. 1-9 and col. 4-line 42 to col. 8-line 40).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zafar et al., U.S. Patent 6,413,819.

Zafar et al. is applied as above but fails to expressly disclose the particle density of the particulate layer. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum particle density based upon a variety of factors including the desired programming characteristics and would not lend patentability to the instant application absent the showing of unexpected results.

Claims 3 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zafar et al., U.S. Patent 6,413,819 in view of Rostoker et al., U.S. Patent 5,521,108.

Zafar et al. is applied as above and discloses forming the floating gate particulate layer of either silicon or germanium but not of silicon-germanium and forming the control

Art Unit: 2812

gate of in-situ doped silicon-germanium with a concentration of germanium ranging from 10-20 weight percent.

Rostoker et al. discloses forming a silicon/germanium floating gate layer 20 and forming an in-situ doped silicon-germanium control gate 50 with a concentration of germanium from 1 to 70 weight percent (see figs. 2-6 and col. 2-line 45 to col. 4-line 57). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the primary reference of Zafar et al. so as to form the silicon-germanium floating and control gate structure of Rostoker et al. because silicon-germanium is shown to be a suitable material for both floating and control gates.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zafar et al., U.S. Patent 6,413,819 in view of Rostoker et al., U.S. Patent 5,521,108 as applied to claims 3 and 10-11 above, and further in view of Bu et al., US 2004/0067631 A1.

Zafar et al. and Rostoker et al. are applied as above but fail to expressly disclose forming the floating gate using RTCVD.

Bu et al. discloses forming SiGe using RTCVD (see paragraph 0038). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Zafar et al. modified by Rostoker et al. so as to form the SiGe floating gate using RTCVD because Bu et al. discloses this as a suitable method in which to form a SiGe layer.

Art Unit: 2812

Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zafar et al., U.S. Patent 6,413,819 in view of Fujiwara, U.S. Patent 6,541,326.

Zafar et al. is applied as above but fails to expressly disclose forming a tunnel oxide film from a high dielectric film from a group containing tantalum oxide.

Fujiwara discloses forming a tunneling film of tantalum oxide (see col. 3-lines 1-4 and fig. 3). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Zafar et al. so as to form the tunneling film of tantalum oxide as suggested by Fujiwara because this is shown to be a suitable material for a tunnel insulator.

Claims 12-13 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zafar et al., U.S. Patent 6,413,819 in view of Nakanishi et al., U.S. Patent 5,504,022.

Zafar et al. is applied as above but fails to expressly disclose forming a tunnel oxide film having a roughened upper surface.

Nakanishi et al. discloses forming a tunnel oxide film with a roughened upper surface (see figs. 4A-4D and their description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Zafar et al. so as to provide a roughened upper surface of a tunnel oxide film because this will improve programming efficiency.

With respect to the particle size, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine

Art Unit: 2812

experimentation the optimum particle density based upon a variety of factors including the desired programming characteristics and would not lend patentability to the instant application absent the showing of unexpected results.

Claims 14 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zafar et al., U.S. Patent 6,413,819 in view of Nakanishi et al., U.S. Patent 5,504,022 as applied to claims 12-13 and 15-16 above, and further in view of Rostoker et al., U.S. Patent 5,521,108.

Zafar et al. and Nakanishi et al. are applied as above and Zafar et al. discloses forming the floating gate particulate layer of either silicon or germanium but not of silicon-germanium and forming the control gate of in-situ doped silicon-germanium with a concentration of germanium ranging from 10-20 weight percent.

Rostoker et al. discloses forming a silicon/germanium floating gate layer 20 and forming an in-situ doped silicon-germanium control gate 50 with a concentration of germanium from 1 to 70 weight percent (see figs. 2-6 and col. 2-line 45 to col. 4-line 57). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the primary reference of Zafar et al. modified by Nakanishi et al. so as to form the silicon-germanium floating and control gate structure of Rostoker et al. because silicon-germanium is shown to be a suitable material for both floating and control gates.

Art Unit: 2812

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over over Zafar et al., U.S. Patent 6,413,819 in view of Nakanishi et al., U.S. Patent 5,504,022 as applied to claims 12-13 and 15-16 above, and further in view of Fujiwara, U.S. Patent 6,541,326.

Zafar et al. and Nakanishi et al. are applied as above but fail to expressly disclose forming a tunnel oxide film from a high dielectric film from a group containing tantalum oxide.

Fujiwara discloses forming a tunneling film of tantalum oxide (see col. 3-lines 1-4 and fig. 3). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Zafar et al. modified by Nakanishi et al. so as to form the tunneling film of tantalum oxide as suggested by Fujiwara because this is shown to be a suitable material for a tunnel insulator.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over over Zafar et al., U.S. Patent 6,413,819 in view of Nakanishi et al., U.S. Patent 5,504,022 and further in view Rostoker et al., U.S. Patent 5,521,108 as applied to claims 14 and 19-20 above, and further in view of Bu et al., US 2004/0067631 A1.

Zafar et al., Nakanishi et al., and Rostoker et al. are applied as above but fail to expressly disclose forming the floating gate using RTCVD.

Bu et al. discloses forming SiGe using RTCVD (see paragraph 0038). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time



Art Unit: 2812


the invention was made to modify the process of Zafar et al. modified by Nakanishi et al. and Rostoker et al. so as to form the SiGe floating gate using RTCVD because Bu et al. discloses this as a suitable method in which to form a SiGe layer.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard A. Booth whose telephone number is (571) 272-1668. The examiner can normally be reached on Monday-Thursday from 7:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (571) 272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Richard A. Booth  
Primary Examiner  
Art Unit 2812

September 29, 2004